

## (12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization  
International Bureau(43) International Publication Date  
8 March 2001 (08.03.2001)

PCT

(10) International Publication Number  
**WO 01/16047 A3**

- (51) International Patent Classification<sup>7</sup>: C04B 33/32,  
B32B 9/00, 19/00
- (21) International Application Number: PCT/US00/22811
- (22) International Filing Date: 18 August 2000 (18.08.2000)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:  
60/149,539 18 August 1999 (18.08.1999) US
- (71) Applicant (for all designated States except US): **RUT-  
GERS, THE STATE UNIVERSITY** [US/US]; 58 Bevier  
Road, Piscataway, NJ 08854-8010 (US).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): **KALMAN, Zwi,**

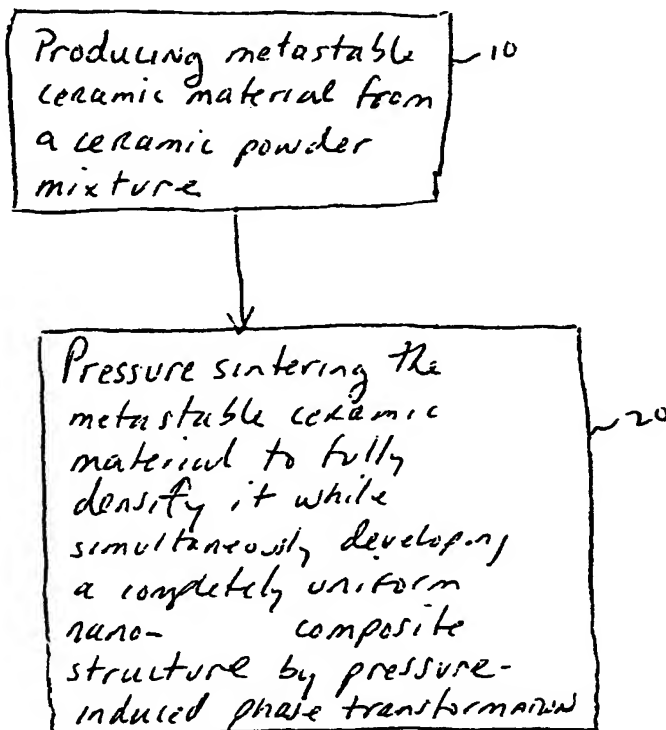
H. [—/IL]; Saadia Gaon Street 14, Jerusalem (IL).  
**KEAR, Bernard, H.** [—/US]; 10 Campbells Brook Road,  
Whitehouse Station, NJ 08889 (US). **MAYO, William,  
E.** [—/US]; 35 Hutchinson Road, Allentown, NJ 08501  
(US). **SKANDAN, Ganesh** [—/US]; 342 Lunar Road,  
Piscataway, NJ 08854 (US).

(74) Agent: **SCHWARZ, Paul, A.**; Buchanan Ingersoll, P.C.,  
4th floor, 650 College Road East, Princeton, NJ 08540  
(US).

(81) Designated States (*national*): AE, AL, AM, AT, AU, AZ,  
BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK,  
DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL,  
IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU,  
LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT,  
RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA,  
UG, US, UZ, VN, YU, ZA, ZW.

[Continued on next page]

(54) Title: COMPOSITE CERAMIC HAVING NANO-SCALE GRAIN DIMENSIONS AND METHOD FOR MANUFACTURING SAME



(57) Abstract: A composite ceramic including a first phase of ceramic material and a second phase of ceramic material, the first and second phases forming three dimensional interconnected networks of each phase and having a nano-scaled grain size. The composite ceramic is produced in a method which utilizes rapid solidification at cooling rates of at least  $\sim 10^4$ °K/sec to produce a metastable material formed by a solid solution of a two immiscible ceramic material phases, and which also utilizes relatively high pressure/low temperature consolidation to complete densification of the metastable material, while simultaneously generating a composite structure with nano-scale grain dimensions through a controlled phase transformation.

WO 01/16047 A3



(84) **Designated States (regional):** ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

(88) **Date of publication of the international search report:**  
7 June 2001

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

**Published:**

- *With international search report.*
- *Before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments.*